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BOX HINGE

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ABSTRACT OF THE DISCLOSURE

A hinge design formed from plastic sheet material susceptible to formation by heat and pressure whereby two flush surfaces may be integrally hinged. The hinge is formed by conforming plastic sheet material into three longitudinal valleys in a mold which are separated by a pair of longitudinal ridges.

BACKGROUND OF THE INVENTION

In the container and packaging fields, production techniques frequently referred to as pressure forming, thermoforming and vacuum forming of plastic sheet material have been widely adopted. Usually, the plastic sheet material is from about 5 mils to 30 mils in thickness and is a vinyl, acetate or similar composition susceptible of being formed by applying heat and force such as pressure forming or vacuum forming. Numerous shapes of lightweight containers can be formed in this manner. The plastic sheet material is relatively tough, flexible and semirigid. However, heretofore efforts to form integrally hinged covers and receptacles have been unsatisfactory.

In particular, hinges which are capable of flexing at least 180° have been proposed by employing cutout portions in a fold in the plastic sheet material. Although such cutouts along a creased portion of the material enhance the hinge's flexibility, the hinge is also weakened and is more susceptible to tearing. Hinges with a curved cross section have also been formed from plastic sheet material, thereby avoiding a sharp edge that is subjected to stress. However, these round types of hinges prevent the mating surfaces or edges of the box from staying flush with each other since the use of such a curved or rolled surface for the hinge causes bowing of the adjacent mating edges. This unwanted bowing can be partially avoided by providing a sharp crease in the sheet material to serve as a hinge. Unfortunately, this type of arrangement, when subjected to several flexing actions, tends to break and tear.

SUMMARY OF THE INVENTION

Briefly, my invention comprises the forming of a hinge from plastic sheet material whereby the hinge has a pair of outer hollow and parallel valleys which extend outwardly along the length of the hinge. Each of these outer loops has a first side connected to one of the mating surfaces of the box and has a second side connected to an adjacent ridge which is parallel to the valleys. A middle valley is formed between the two ridges. This unique configuration provides a hinge that is capable of withstanding many flexing operations extending over at least a 180° range. The three valley surfaces absorb the various forces resulting from flexing the hinge and prevent any tearing or unwanted strain on the hinge. In addition, these three hinge surfaces cooperate to maintain the two mating surfaces of the container flush without any bowing effect.

Thus, it is one object of this invention to provide a new and improved hinge formed from plastic sheet material. Another object of this invention is to provide a method for forming a hinge from plastic sheet material in accordance with conventional thermoforming techniques. Other objects and advantages of this invention will be apparent

upon reading the following descriptions in connection with the drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of a box with the integral hinge of this invention;

FIG. 2 is a partial view of a mold for forming the box and hinge of FIG. 1 taken in cross section on a line transversing the cover and box mold elements;

FIG. 3 is an end view of the hinge of this invention as it appears when removed from the mold; and

FIG. 4 is an end view of the hinge when its associated cover and bottom are closed.

DETAILED DESCRIPTION OF INVENTION

Referring to the drawing, a container **11** is illustrated which in the particular embodiment comprises a rectangular box. Container **11** has a cover **13** and a base **14**. Cover **13** and base **14** are similar in configuration with respective top and bottom surfaces **16** and **17**, side walls **19** and **20**, front walls **24** and **25**, rear walls (not visible) and abutting flanges **27** and **28** extending about the peripheries of the container's walls.

It is to be understood that the invention described herein is applicable to a variety of containers, receptacles and the like and is not restricted to the particular type container shown in the drawing. Cover **13** and base **14** are integrally joined by hinge **30**. It is to be noted that this hinge has a pair of hollow and parallel outer valleys **32** and **33** (FIGS. 1 and 4) which extend outwardly along the length of the container. Each of these valleys has an arcuate cross section thereby avoiding a sharp creased effect. A middle hollow valley **34** is connected to the outer valleys by a pair of ridges **35** and **36**.

Outer valley **32** is connected to flange **27** adjacent the cover's rear wall. Likewise, valley **33** is connected to flange **28** on base **14**. Valleys **32** and **33** are also connected along their lengths to middle valley **34** by ridges **35** and **36**. As shown in FIG. 3, middle valley **34** is deeper than outer valleys **32** and **33**. The degree of curvature for the three arcuate valleys may be identical and may approximate a 180° arc. Ridges **35** and **36** may be of identical configuration and dimension.

In forming the hinge of this invention by conventional thermoforming techniques, a mold **38** is used which has a removable inset die **39** (FIG. 2). Formed into this die are three parallel arcuate recesses **41**, **42** and **43** which will form the three arcuate valleys **32**, **33** and **34** of the hinge. Positioned between these three recesses are two upwardly extending longitudinal ridges **45** and **46**. The height of the ridges should not extend above (and preferably be lower than) the mold's adjacent top surface **44**. The width of these ridges is preferably less than the radius for the arcuate recesses **41**, **42** and **43**.

One set of dimensions for a satisfactory hinge is as follows, referring to FIG. 3:

r (radius of each valley) = .062 inch
w (width of ridge) = .0312 inch
d_1 (depth of outer valleys **32** and **33**) = .150 inch
d_2 (depth of middle valley **34**) = .187 inch
d_3 (depth of ridges) = .062 inch

The above dimensions have been found satisfactory for a variety of plastic sheet materials including styrene and propionate of a thickness as thin as .005 inch to .035 inch. When these dimensions are increased proportionately, sheet material as thick as .060 inch may utilize the hinge of this invention.

Thus, it can be seen from FIG. 3 that the integrally connected cover and base of the receptacle are formed in substantially one primary horizontal plane. This forming occurs by placing a flat sheet of plastic material of the